Original Article Journal of Clinical Orthopaedics 2021 January-June;7(2):100-103

Management of Periprosthetic Femoral Fractures following Total Hip Replacement: A Case Series

Lokesh Kumar Yogi[1], Vijay Chandrakant Shinde[1], Moti Janardhan Naik[1], Vikash Kumar[2]

Abstract

Background: Periprosthetic femoral fractures following total hip arthroplasty (THA) are not very uncommon. At present the Vancouver classification provides management algorithm for deciding treatment options but treatment options may vary between surgeons, where as in this study most patients managed were according to Vancouver classification management algorithm. The most common treatment modality for treating periprosthetic femoral fractures around a well-fixed stem is with osteosynthesis, but fracture with loose stem requires revision arthroplasty and fracturewith poor bone requires bone graft augmentation.

Methods: We reviewed 21 consecutive cases with periprosthetic femoral fractures in association with THA between June 2018 and December 2020. Locking and non locking compression plates, wires, cables system were used for osteosynthesis. Most of fractures were managed according to Vancouver classification management algorithm but modified in some cases according to the surgeon's skills and judgment.

Results: According to Vancouver classification, two patients had AL fractures, two patients had AG fractures, twelve Patients had B1, five patients had B2, two patients had B3 and one patient had type C fracture. Of these two cases were treated by conservatively, sixteen cases were treated by osteosynthesis, three cases by revision arthroplasty.

Conclusion: The careful analysis of implant stability and fracturepatterns is crucial for the optimal treatment of Periprosthetic femoral fractures. Expert Surgeon's skills are needed to deal with periprosthetic femoral fractures.

Keywords: Locking compression plate, periprosthetic fractures, total hip arthroplasty, Vancouver classification.

Introduction

The incidence of periprosthetic femoral fractures in association with total hip arthroplasty (THA) is increasing as they continue to rise in direct proportion to the number of THA procedures performed, the aging population and complications such as osteolysis and aseptic loosening [1]. As cementless THA procedures are performedin advanced age patients, who have osteoporotic bone, intraoperative fracture easily, occur when strong compression is applied to achieve initial stability. Whereas periprosthetic femoral fractures are also commonly seen in patients who underwent cementless hip arthroplasty, despite osteoporotic bone, after falling down, compared to cemented THA [2]. Periprosthetic femoral fractures following THA are mostly associated with trauma; however, they may also be caused by local and systemicfactors including advanced age, osteoporosis, systemic steroids, prosthetic instability/loosening of prosthesis, and osteolysis [3,4].

Now days the most common classification using for femoral periprosthetic femoral fractures is Vancouver classification [5] (Fig. 1).

An algorithmic treatment approach for femoral periprosthetic fractures according to the Vancouver classification system is currently widely recommended [6]. Although the Vancouver classification has been tested for validity and reliability with results showing interobserver reliability of substantial agreement [7].

An algorithm for better identifying loose stems in patients suffering from a periprosthetic fracture after THA (Fig. 2).

The operative modality for periprosthetic femoral fractures range from minimally invasive procedures to revision arthroplasty. There are various procedures such as cerclage, cables, locking and non locking plates, bone grafting. The fixation of periprosthetic

[1]Department of Orthopaedic Surgery, Government Medical College, Aurangabad, Maharashtra, India,
[2]Department of Orthopaedic Surgery Deen Dayal Upadhyaya Hospital, New Delhi, India.

Address of Correspondence
Dr. Lokesh Kumar Yogi,
Department of Orthopaedic Surgery, Government Medical College, Aurangabad, Maharashtra, India.
E-mail: lokesh.k.yogi@gmail.com

Submitted Date: 19 Nov 2022, Review Date: 24 Jan 2022, Accepted Date: 27 Jan 2022 & Published Date: 31 Mar 2022

| Journal of Clinical Orthopaedics | Available on www.jcorth.com | DOI:10.13107/jcorth.2022.v07i01.485

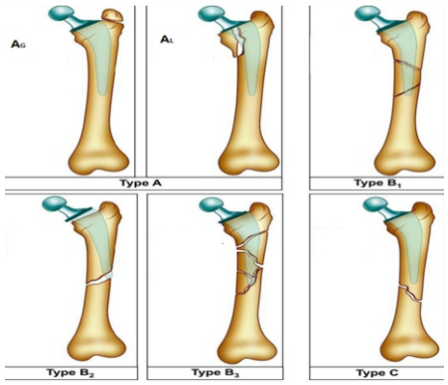

Figure 1: Vancouver classification for periprosthetic femoral fracture.

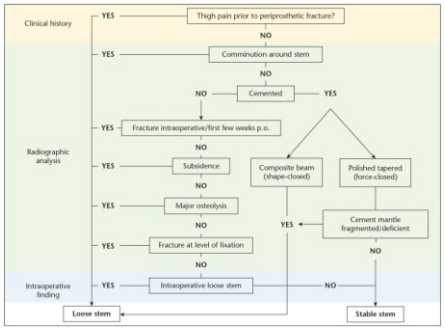

Figure 2: An algorithm for better identifying loose stems or stable stem in patients suffering from a periprosthetic fracture after total hip arthroplasty.

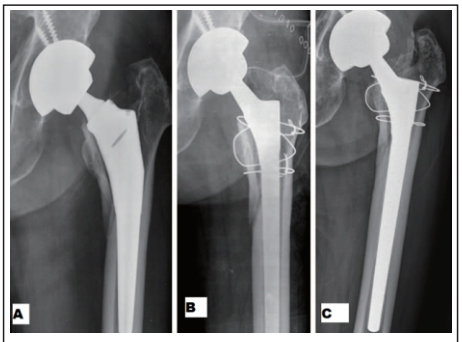

Figure 3: Preoperative anterior-posterior (AP) radiographs of the left hip (A) showing a periprosthetic femoral fracture was judged to be Vancouver type AL. Postoperative AP radiographs of the hip (B and C) views demonstrating fixation with Cerclage Wiring.

femoral fracture depends on whether the prosthesis is still well fixed or has loosened or broken through the fracture [8,9].

Materials and Methods

This study was performed following an approval from the institutional review board and we reviewed 21 consecutive cases with periprosthetic femoral fractures in association with THA between June 2017 and December 2019. Periprosthetic femoral fractures were classified according to the Vancouver system [8] and the mean onset period of a periprosthetic femoral fracture following THA was 9 years 3 months (range, 3 years-30 years). The mean age of patients at the time of fracture was 65.33 years (range, 42–82 years). Twelve patients were male and nine were female. The average follow-up period was 12 months (range, 12–24 months).The type of femoral stem used was cemented in five cases and uncemented in sixteen cases. As showing in Table 1, fractures were caused by a fall or minor trauma (n=16) or non-traumatic event (n=5). Fractures classified by Vancouver classification

Results

According to Vancouver Classification two patients had AL fractures, one patient had AG fracture, ten Patients had B1, five patients had B2, two patients had B3 and one patient had C fracturs. Of these two cases were treated by conservatively, sixteen cases were treated by osteosynthesis, three cases by revision arthroplasty (in which one patient was treated with Revision Arthroplasty with Cerclage Wiring). In osteosynthesis a LCP system was used for nine patients, LCP with Cable used for four patients and Cerclage Wiring only for two patient and Tension Band Wire for one patient. Bone grafting was used in three patient those who had bone loss.

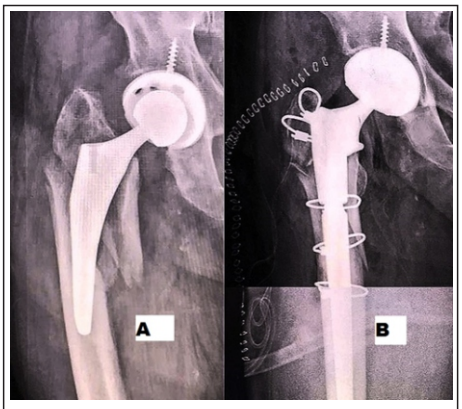

Figure 3: Preoperative anterior-posterior (AP) radiographs of the right hip (A) showing a periprosthetic femoral fracture was judged to be Vancouver type B2. Postoperative AP radiographs of the hip (B) view demonstrating fixation with Revision Arthroplasty + Cerclage Wiring.

Figure 5: Preoperative AP radiographs of the right hip (A and B), showing a periprosthetic femoral fracture was judged to be Vancouver type B3. Postoperative AP radiographs of the hip (B and C) views demonstrating fracture fixation with distal femoral locking compression plate.

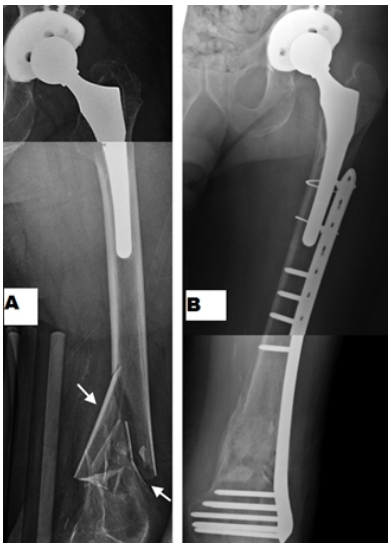

Figure 6: Preoperative anterior-posterior (AP) radiographs of the left hip (A) showing a periprosthetic femoral fracture was judged to be Vancouver type C. Postoperative AP radiographs of the hip (B) views demonstrating fixation with locking compression plate.

Table 1: Patient characteristics and treatment information

Case	Sex/age (years)	Primary THA	Vancouver Type	Treatment method	Bone graft used
1	M/42	Uncemented	B_1	LCP	-
2	M/46	Uncemented	B_2	LCP+Cable	Bone graft
3	F/49	Uncemented	B_1	LCP	-
4	M/51	Uncemented	B_1	Cerclage wiring	-
5	M/54	Uncemented	B_3	LCP+Cable	Bone graft
6	M/55	Uncemented	B_1	LCP	-
7	M/60	Uncemented	A_L	Cerclage wiring	-
8	F/62	Uncemented	B_2	LCP+Cable	-
9	F/62	Uncemented	B_1	LCP	-
10	M/64	Uncemented	B_3	Revision arthroplasty	-
11	F/67	Uncemented	B_2	Revision arthroplasty+Cerclage wiring	-
12	F/71	Uncemented	B_1	LCP	-
13	M/71	Uncemented	B_2	LCP+Cable	-
14	M/72	Cemented	A_L	Conservative	-
15	F/76	Uncemented	C	LCP	Bone graft
16	M/76	Cemented	B_1	LCP	-
17	F/77	Cemented	B_1	LCP	-
18	M/79	Uncemented	B_1	LCP	-
19	F/80	Cemented	A_G	Tension band wire	-
20	F/80	Uncemented	B_2	Revision arthroplasty	-
21	M/82	Cemented	B_1	Conservative	-

THA: Total hip arthroplasty, LCP: Locking compression plate

Discussion

The incidence of femoral periprosthetic fractures following THR varies according to the surgeons, but the prevalence of THR has been on the increase in recent years, along with an expanded range of indications for surgery and growing number of elderly [10]. In particular, surgical management needs to be considered carefully in older patients with osteoporosis, who are at high risk of fractures, since treatments that result in fractures are not satisfactory [11, 12]. The management of fractures along the femoral stem with loosening and poor bone stock depends on both the severity and distribution of bone loss. Options include revision with distally fixed stems, proximal femoral replacement with allograft prosthesis composite, requires revision arthroplasty and fracture with poor bone require bone graft augmentation [13, 14].

A few aspects may be considered as limitations of the proposed Vancouver classification management algorithm. Although the algorithm serves to identify loose stems, it is not a sole guide for the best type treatment option, i.e. patient factors such as sex, age and health conditions have to be considered too [15].

Sledge et al. study reported on seven patients with Vancouver B2 fractures managed with stem removal, wiring of the fracture with bone graft, and implantation of a long, uncemented femoral stem. A fully porous-coated femoral stem was used in four cases and modular proximally loading implant was used in three cases. At 33 months average follow-up with average Harris hip score of 83 reported and no failures, no refractures noted [16].

Beals et al. study reported the results of 93 periprosthetic femoral fractures treated at various modalities by multiple surgeons. Overall, outcomes were considered excellent in 32% of cases, good in 16%, and poor in 52%. Most fractures except AL and AG had a poor result with conservative treatment. The complication rates were 33 % related to THR and 41% related to fracture [17].

Mont et al. meta-analysis study reported the most satisfactory outcomes for type 2, 3, and 4 fractures (around the tip of the stem) with cerclage wiring or long-stem revision arthroplasty. Conservative or plating management with traction generally lead to unsatisfactory outcomes. Highly comminuted Type 5 fractures appeared to be best treated with long-stem revision arthroplasty [18].

Our results demonstrate good success rate in treating the majority of periprosthetic femur fractures. We achieved satisfactory results by conducting conservative management in two patients with one was AL and one was B1 type fractures, revision with a long femoral stem and plate fixation without bone graft in ten patients with B1, B2 and C type fractures, and plate fixation and an allograft in three patient with B2 ,B3 and C type fracture, and revision arthroplasty in three patient with type B2, B3 fracture, and wiring for three patients in type AL, AG, and B1 fracture. We suggest that favourable results can be anticipated when intraoperative periprosthetic femoral fractures are managed using Vancouver

classification management algorithm [19,20] (Figs. 3-6).

Conclusion

The careful analysis of stem stability and fracture patterns is crucial for the optimal treatment of periprosthetic femoral fractures. The goals of treatment are fracture reduction and healing, while allowing for early mobilization of both the patient and the affected joint. Ultimately surgeon's skills are needed to deal with periprosthetic femoral fractures.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL; **Source of Support:** NIL

References

1. Lindahl H. Epidemiology of periprosthetic femur fracture around a total hip arthroplasty. Injury. 2007;38(6):651-4.
2. Berend ME, Smith A, Meding JB, Ritter MA, Lynch T, Davis K. Long-term outcome and risk factors of proximal femoral fracture in uncemented and cemented total hip arthroplasty in 2551 hips. J Arthroplasty. 2006;21(6 Suppl 2):53-9
3. Garbuz DS, Masri BA, Duncan CP. Periprosthetic fractures of the femur: principles of prevention and management. Instr Course Lect. 1998;47:237-42.
4. Haddad FS, Masri BA, Garbuz DS, Duncan CP. The prevention of periprosthetic fractures in total hip and knee arthroplasty. Orthop Clin North Am. 1999;30:191-207.
5. Katzer A, Ince A, Wodtke J. Component exchange in treatment of periprosthetic femoral fractures. J Arthroplasty. 2006; 21:572-9.
6. Brady OH, Garbuz DS, Masri BA, Duncan CP. The reliability and validity of the Vancouver classification of femoral fractures after hip replacement. J Arthroplasty2000;15:59–62.
7. Naqvi GA, Baig SA, Awan N. Interobserver and intraobserver reliability and validity of the Vancouver classification system of periprosthetic femoral fractures after hip arthroplasty. J Arthroplasty 2012;27:1047-1050.
8. Tsiridis E, Haddad FS, Gie GA. The management of periprosthetic femoral fractures around hip replacements.Injury. 2003;34:95-105.
9. Grammatopoulos G, Pandit H, Kambouroglou G. A unique peri-prosthetic fracture pattern in well xed femoral stems with polished, tapered, collarless design of total hip replacement. Injury. 2011; 42:1271-6.
10. Campbell P, Mcwilliams TG. Periprosthetic femoral fractures. CurrOrthop. 2002;16:126-32.
11. Lewallen DG, Berry DJ. Periprosthetic fracture of the femur after total hip arthroplasty: treatment and results to date. Instr Course Lect. 1998;47:243-9.
12. Lindahl H, Malchau H, Herberts P, Garellick G. Periprosthetic femoral fractures classification and demographics of 1049 periprosthetic femoral fractures from the Swedish NationalHip Arthroplasty Register. J Arthroplasty. 2005;20:857-65.
13. Corten K, Vanrykel F, Bellemans J, Frederix PR, Simon JP, Broos PL. An algorithm for the surgical treatment of periprosthetic fractures of the femur around a well-fixed femoral component. J Bone Joint Surg Br 2009;91(11):1424–1430.
14. Marsland D, Mears SC. A review of periprosthetic femoral fractures associated with total hip arthroplasty. GeriatrOrthopSurgRehabil 2012;3(3):107–120.
15. Streubel PN. Mortality after periprosthetic femur fractures. J Knee Surg2013;26:27–30.
16. Sledge JB, Abiri A (2002) An algorithm for the treatment of Vancouver type B2 periprosthetic proximal femoral fractures. J Arthroplasty 17:887–892
17. Beals RK, Tower SS (1996) Periprosthetic fractures of the femur. An analysis of 93 fractures. Clin Orthop 327:238–246
18. Kavanagh BF. Femoral fractures associated with total hip arthroplasty. Orthop Clin North Am. 1992;23:249-57.
19. McElfresh EC, Coventry MB. Femoral and pelvic fractures after total hip arthroplasty. J Bone Joint Surg Am. 1974;56:483-92.
20. Porsch M, Galm R, Hovy L, Starker M, Kerschbaumer F (1996) Total femur replacement following multiple periprosthetic fractures between ipsilateral hip and knee replacement in chronic rheumatoid arthritis. Case report of 2 patients. Z Orthop Ihre Grenzgeb 134(1):16-20

Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article

Yogi LK, Shinde VC, Naik MJ, Kumar V. Management of periprosthetic femoral fractures following total hip replacement: A case series. Journal of Clinical Orthopaedics Jan-Jun 2022;7(1):100-104.